7-16-04 120 AF/2123

Atty. Dkt. No.: 2493

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of
Douglas CLAFFEY *et al.*
Appln. No.: **09/332,760**
Filed: June 14, 1999
Group Art Unit: 2123
Conf. No.: 3302
Examiner: H. Jones
Title: *Method And Apparatus For Determining Obscuration Of Sensors That Are Mounted On A Spacecraft*

APPELLANT'S BRIEF ON APPEAL UNDER 37 C.F.R. § 1.192

M/S Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In accordance with the provisions of 37 C.F.R. § 1.192, Appellant submits the following:

I. REAL PARTY IN INTEREST

Based on information supplied by Appellant, and to the best of Appellant's legal representatives' knowledge, the real party in interest is the assignee, Analytical Graphics, Inc.

II. RELATED APPEALS AND INTERFERENCES

Appellant, as well as Appellant's assigns and legal representatives are unaware of any appeals or interferences which will be directly affected by, or which will directly affect, or have a bearing on the Board's decision in the pending appeal.

Date: July 15, 2004 RA&M Ref. No.: 2493-039

III. STATUS OF CLAIMS

Claims 1-18, 23-26, and 30-35 are currently pending. Claims 19-22 and 27-29 have been canceled. Claims 1-18, 23-26, and 30-35 are appealed. Claims 1-18, 23-26, and 30-35, as finally rejected, are set forth in the attached Appendix.

IV. STATUS OF AMENDMENTS

No amendment has been filed subsequent to the final rejection.

V. SUMMARY OF THE INVENTION

Appellant's invention pertains to software simulation and visualization of spacecraft, typically satellites. In planning a given satellite's mission it is useful to simulate what the sensors of the satellite will be able to visualize at what times and for how long. One very real limitation on what a sensor of a satellite can "see" is that another part of the satellite itself may be hindering, at least partially, the view of a desired sensing target. This is a real concern because spacecraft are often encrusted with many objects including multiple types of sensors, communications antennas, thrusters, solar power panels and the like, as well as the frameworks and beams on which such objects may be mounted.

Rather than using old-fashioned, clock-cycle-hungry

mathematical methods for calculating a sequence of numerical results at every moment in time that indicate precisely the degree to which a desired sensing target is obscured, Appellant has taken the art in a new direction. Appellant's innovation is to take an existing aerospace animation software program and make the visualization view point be that of the sensor itself and then leverage the powerful graphics rendering capabilities of modern computers to quickly display (using a contrasting color) those portions of the sensor's view that are obscured. Rather than using complex mathematical techniques to calculate the degree of obscuration, the number of pixels of a given color are summed and a simple ratio taken to arrive at an obscuration percentage result. This is done in each frame (i.e., at each point in time) in the simulation with relatively little computer resources expended.

This accomplishes two advantages at once. First, it provides an animated visualization that gives the person viewing the simulation an immediately intuitive feel for whether the obscuration is substantial, slight, or nonexistent. Second, it provides a reasonably precise running measure of the degree of obscuration without the need for an extraordinary amount of mathematical processing power.

The present invention is embodied according to four aspects

that have been claimed: a process, a machine, a computer program product, and a signal bearing medium propagating a signal.

A process according to the present invention analyzes sensor obscuration. The process includes the steps of animating a three-dimensional visualization of a satellite that includes a sensor object, the sensor object having a boresight and a sensor pattern, as well as selecting a view perspective from the sensor object along the boresight. *See* specification at page 9, lines 1-10. The process further includes selecting objects of a satellite system analysis scenario that are capable of causing obscuration, and assigning a first color to the selected objects, while assigning a second color to unselected objects and background of the satellite system analysis scenario. *Id.* at page 9, lines 11-16. The process also includes assigning to the sensor pattern a color that contrasts with the first color, such that, when the sensor pattern is superimposed over a visual display of the satellite system analysis scenario, portions of the sensor pattern that overlap with unselected objects and background appear in a different color than do portions of the sensor pattern that overlap with selected objects. *Id.* at page 9, lines 16-23. The quantities of pixels of each color in the sensor pattern are counted and recorded, the counting and

recording being carried out at each time step of animation of the satellite system analysis scenario. *Id.* at page 10, lines 1-2. The process further includes providing a graphical display to a user, during the animation, portraying the amount of obscuration of the sensor pattern and the source of obscuration of the sensor pattern, over a predetermined time period, and calculating the percentage of obscuration over that predetermined time period on the basis of the recorded pixel quantities. *Id.* at page 10, lines 4-10.

A machine according to the present invention takes the form of a general purpose computer that implements the process as discussed in the preceding paragraph. *Id.* at page 7, lines 14-20.

A computer program product according to the present invention takes the form of a computer readable medium that embodies software instructions that correspond to the process discussed above. *Id.* at page 6, lines 8-13.

A signal bearing medium propagating a signal according to the present invention provides a way to provide the advantages of the above-described method remotely over a channel. The various actions of the invention are provided through the signal bearing medium of a channel as signal segments of a propagated signal.

The propagated signal includes an animation signal segment that provides for animated three-dimensional visualization of a spacecraft having a sensor object, the sensor object having a boresight and a sensor pattern, as well as a perspective selection signal segment that provides for a visualization view from the perspective of said sensor object, along said sensor object's boresight. *Id.* at page 11, line 21; page 12, lines 12-13. The propagated signal further includes a selection signal segment that enables selection of obscuring objects to be taken into account in the obscuration analysis, and a simplification signal segment that simplifies visual display provided by said animation code segment to show the selected obscuring objects in a first color. *Id.* at page 12, lines 1-4. The propagated signal also includes a distinguishing signal segment that assigns a second color to portions of the sensor object's field of view that are obscured by the selected obscuring objects and a third color to those portions of the sensor object's field of view that are not obscured, to thereby distinguish obscured portions of the sensor object's field of view from unobscured portions of the sensor object's field of view. *Id.* at page 12, lines 3-8. A quantifying signal segment counts and records a quantity of pixels corresponding to obscured portions of the sensor object's

field of view at each of plural animation time steps, and that counts and records a quantity of pixels corresponding to unobscured portions of the sensor object's field of view at each of the plural animation time steps. *Id.* at page 12, lines 9-11. The propagated signal also includes a results signal segment that calculates, based on the quantities of pixels counted and recorded by said quantifying code segment, and reports to a user percent obscuration of the sensor object's field of view over a predetermined time period. *Id.* at page 12, lines 16-18.

VI. ISSUES

The issues on appeal are:

Issue 1 - Are claims 1-18, 23-26, and 30-35 enabled, within the meaning of 35 U.S.C. § 112, ¶ 1st, by the specification?

Issue 2 - Are claims 1-18, 23-26, and 30-35 anticipated, within the meaning of 35 U.S.C. § 102(a), by STK version 3.0, or STK version 4.0.5., or "Sensor Obscuration Tool (STK/Advanced VO)," or Satellite Tool Kit systems analysis program, cert. nos. TX4-819-009, TX4-819-010, or TX4-819-011?

Issue 3 - Are claims 1-18, 23-26, and 30-35 anticipated, within the meaning of 35 U.S.C. § 102(b), by STK version 3.0, or STK version 4.0.5., or "Sensor Obscuration Tool (STK/Advanced VO)," or Satellite Tool Kit systems analysis program, cert. nos.

TX4-819-009, TX4-819-010, or TX4-819-011?

Issue 4 - Are claims 1-18, 23-26, and 30-35 anticipated, within the meaning of 35 U.S.C. § 102(f), by STK version 3.0, or STK version 4.0.5., or "Sensor Obscuration Tool (STK/Advanced VO)," or Satellite Tool Kit systems analysis program, cert. nos. TX4-819-009, TX4-819-010, or TX4-819-011?

Issue 5 - Are claims 1-18, 23-26, and 30-35 obvious, within the meaning of 35 U.S.C. § 103(a), over Claffey *et al.* (US 5864489) in view of an admission, Blank (US 5469536), and Cok (US 5710839)?

VII. GROUPING OF CLAIMS

All the appealed claims stand or fall according to the following six groups:

Group 1 → Claims 1-12

Group 2 → Claims 13-18

Group 3 → Claims 23 and 24

Group 4 → Claims 25 and 26

Group 5 → Claims 30-32

Group 6 → Claims 33-35

VIII. ARGUMENTS

ISSUE 1 - Rejection Under 35 U.S.C. § 112, ¶ 1st - Enablement

The standard for enablement is whether undue experimentation

is necessary for a person of ordinary skill in the art to make or use the invention. *Mineral Separation v. Hyde*, 242 U.S. 261, 270 (1916); *In re Wands*, 858 F.2d 731,737, 8 U.S.P.Q.2d 1400, 1404 (Fed. Cir. 1988).

As set forth in the final Office Action, the Examiner supports the conclusion of nonenablement with a single factual finding:

> Applicants have only disclosed generalities of the claimed invention. There is no detailed disclosure relating to any of the claim limitations.

See Paper No. 13 at page 3, lines 14-15.

In contrast, Appellant has submitted evidence of enablement in the form of a Declaration by industry expert Richard J. Rabbitz. Mr. Rabbitz's testimony addresses in detail the factual basis relevant to how much experimentation it would take for persons of ordinary skill in the art to make software according to the claimed invention. *See generally* Declaration of Richard J. Rabbitz. Mr. Rabbitz's testimony addresses the nature of the claimed invention. *Id.* at page 4, lines 4-5. Mr. Rabbitz's testimony addresses the level of one of ordinary skill. *Id.* at page 4, lines 3-7 and 16-20; page 5, line 17, to page 6, line 2; page 6, lines 16-21; and page 7, line 19, to page 8, line 2. Mr. Rabbitz's testimony addresses the amount of direction provided by

the inventor. *Id.* at page 4, lines 12-16; page 5, lines 1-3, and 9-13; page 6, lines 3-5; and page 7, lines 1-11. Mr. Rabbitz's testimony addresses the quantity of experimentation needed to make the invention. *Id.* at page 7, lines 12-18.

The Declaration of industry expert Richard J. Rabbitz shows that it would take one or more persons of ordinary skill in the art (either in a solitary effort or working as a team) 440 man-hours to make the claimed invention based solely on the disclosure as filed and publicly available information.

Appellant respectfully submits that the estimated software development time of 440 man-hours would not amount to undue experimentation. The U.S. Court of Appeals for the Federal Circuit has ruled that even 800 man-hours spent in developing a working system according to the teachings of a patent disclosure does not meet the level of undue experimentation. *Lindemann Maschinenfabrik GmbH* v. *American Hoist and Derrick Co.*, 730 F.2d 1452, 221 U.S.P.Q. 481 (Fed. Cir. 1984).

Comparing the single factual finding cited by the Examiner with the substantial factual basis cited by Appellant, Appellant respectfully submits that the weight of the substantial evidence is clearly in favor of a conclusion that the claims are enabled.

The Examiner has raised the issued that certain subject

matter that had been incorporated by reference (copyright registrations nos. TX4-819-009, TX4-819-010, and TX4-919-011) must be included *in toto* in the specification on the basis that they include subject matter that is essential to enable the claims. However, Appellant notes that Mr. Rabbitz's expert testimony concerning how persons having ordinary skill in the art would make the claimed invention rests on a factual basis that does not refer to any of the cited copyright registrations. Thus, Appellant respectfully submits that it is reasonable to conclude that these copyright registrations are not essential to enablement of the claimed invention.

The Examiner has also raised the issue that deleting from the specification the reference to the copyright registrations introduces new matter. The Examiner bases this new matter finding on the theory that taking out the references to the copyright registrations changes the scope of the specification and thus changes the scope of the claims because the copyright registrations contained "essential material." *See* Paper No. 13 at page 2, lines 8-13. Thus, it is seen that the new matter finding is another aspect of the Examiner's contention that the copyright registrations include subject matter that is essential to enable the claims. As explained in detail in the preceding paragraph, these copyright registrations are not essential to

enablement of the claimed invention.

In view of the above arguments, Appellant respectfully submits that claims 1-18, 23-26, and 30-35 are enabled by the specification.

ISSUE 2 - Rejection Under 35 U.S.C. § 102(a)

This anticipation rejection is based on the publication of software products, software features, and copyright registrations identified as: STK version 3.0, or STK version 4.0.5., or "Sensor Obscuration Tool (STK/Advanced VO)," or Satellite Tool Kit systems analysis program, cert. nos. TX4-819-009, TX4-819-010, or TX4-819-011. These references are a part of the Satellite Took Kit (or "STK") products and their related documentation, which have been, and continue to be, published exclusively by Analytical Graphics, Inc., the assignee of the entire right, title, and interest in the present application.

Section 102(a) of the Patent Statue defines certain prior art that was made "by others." 35 U.S.C. § 102(a); *In re Katz*, 687 F.2d 450, 215 U.S.P.Q. 14 (C.C.P.A. 1982).

Because section 102(a) prior art must be made by others, none of the cited references qualify as prior art under this section, with respect to the claimed invention. One of the co-inventors, who is also the President of Analytical Graphics, Inc.

has provided testimony that is relevant to this issue. *See generally* Declaration of Paul Graziani. Specifically, Mr. Graziani testifies:

> The subject matter disclosed and claimed in the '760 application that has been implemented in STK was invented by me together with my co-inventors Douglas Claffey and Deron Ohlarik, not by others.

Id. at page 2, lines 14-17. Thus, the publication and sale by Analytical Graphics, Inc. of STK implementing the claimed invention is attributable solely to Applicant's own acts and is not, thus, an act "by others" as is required by § 102(a).

Accordingly, Appellant respectfully submits that claims 1-18, 23-26, and 30-35 are not anticipated under § 102(a).

ISSUE 3 - Rejection Under 35 U.S.C. § 102(b)

This anticipation rejection is based on the publication of software products, software features, and copyright registrations identified as: STK version 3.0, or STK version 4.0.5., or "Sensor Obscuration Tool (STK/Advanced VO)," or Satellite Tool Kit systems analysis program, cert. nos. TX4-819-009, TX4-819-010, or TX4-819-011. These references are a part of the Satellite Took Kit (or "STK") products and their related documentation, which have been, and continue to be, published exclusively by Analytical Graphics, Inc., the assignee of the entire right, title, and interest in the present application.

Section 102(b) of the Patent Statue defines certain prior art that was made "more than one year prior to the date of application for patent in the United States." 35 U.S.C. § 102(b).

One of the co-inventors, who is also the President of Analytical Graphics, Inc. has provided testimony that is relevant to this issue. *See generally* Declaration of Paul Graziani. Specifically, Mr. Graziani testifies:

> No sale, or offer of sale, of a version of STK implementing the subject matter disclosed and claimed in the '760 application occurred more than one year prior to the June 14, 1999 filing date of the '760 application.
>
> Versions of STK sold more than one year prior to the June 14, 1999 filing date of the '760 application did not include implementation of the invention claimed in the '760 application.

Id. at page 2, lines 7-13. Appellant respectfully submits that this testimony by Mr. Graziani definitively elucidates that none of the cited references negatives patentability under § 102(b).

Accordingly, Appellant respectfully submits that claims 1-18, 23-26, and 30-35 are not anticipated under § 102(b).

ISSUE 4 - Rejection Under 35 U.S.C. § 102(f)

This anticipation rejection is based on the publication of software products, software features, and copyright registrations identified as: STK version 3.0, or STK version 4.0.5., or

"Sensor Obscuration Tool (STK/Advanced VO)," or Satellite Tool Kit systems analysis program, cert. nos. TX4-819-009, TX4-819-010, or TX4-819-011. These references are a part of the Satellite Took Kit (or "STK") products and their related documentation, which have been, and continue to be, published exclusively by Analytical Graphics, Inc., the assignee of the entire right, title, and interest in the present application.

Section 102(f) of the Patent Statue defines certain prior art that would indicate that the inventor "did not himself invent the subject matter sought to be patented." 35 U.S.C. § 102(f).

The Examiner has identified the concern that the cited references may potentially have been authored by persons other than the inventors listed for this application. To address this concern, one of the co-inventors, who is also the President of Analytical Graphics, Inc. has provided testimony that is relevant to this issue. *See generally* Declaration of Paul Graziani. Specifically, Mr. Graziani testifies:

> The subject matter disclosed and claimed in the '760 application that has been implemented in STK was invented by me together with my co-inventors Douglas Claffey and Deron Ohlarik, not by others.

Id. at page 2, lines 14-17. Accordingly, Appellant respectfully submits that any implementation of the claimed invention in the cited references is attributable solely to the work of

Appellants, thus, is not a derivation of the invention of another as is required by § 102(f).

Accordingly, Appellant respectfully submits that claims 1-18, 23-26, and 30-35 are not anticipated under § 102(f).

ISSUE 5 - The Obviousness Rejection

A. Not All Claim Limitations Are in the Prior Art

In order to make out a *prima facie* case of obviousness, the prior art must teach or suggest each and every limitation of the claimed invention. That is because the invention must be considered as a whole. *In re Hirao*, 535 F.2d 67, 190 U.S.P.Q. 15 (C.C.P.A. 1976).

Independent process claim 1 recites the limitations of:

> selecting a view perspective from the sensor object along the boresight;
> selecting objects of a satellite system analysis scenario that are capable of causing obscuration;

at lines 7-10, and

> providing a graphical display to a user, during the animation, portraying the amount of obscuration of the sensor pattern, and source of obscuration of the sensor pattern, over a predetermined time period;

at lines 23-26. Independent claims 7, 13, 23, and 25 recite similar limitations. Independent method claim 30 recites the limitations of:

> supplementing the available view perspectives for the satellite system analysis program so as to include a view from the sensor, along the boresight of the sensor;
>
> supplementing the satellite system analysis program with a code segment that enables a user to select objects to be taken into account for analysis of obscuration of the sensor pattern as viewed along the boresight of the sensor;

at lines 6-12. Independent claim 33 recites similar limitations.

When considered together, the Claffey *et al.*, Blank, and Cok references, and the identified admission do not teach or suggest these limitations.

Although Claffey *et al.* discloses the general idea of how to select objects, it makes no suggestion to select the particular objects claimed, that is, objects to be taken into account for sensor obscuration. Claffey *et al.* does not disclose selecting a view perspective along a boresight.

The Examiner identifies that Appellant has admitted as follows:

> Prior methods for calculation of sensor obscuration are accomplished only by performing complex and time-consuming mathematical operations on extensive data regarding the spacecraft's orbit or trajectory, its attitude, desired times for image capture, and other factors. Moreover, while this process may yield numerical data relating the obscuration level to time, it does not provide an easy and reliable way of modeling the data visually, to facilitate the development of alternative designs to minimize the amount of obscuration.

See specification at page 2, lines 17-23. Although it is true

that Appellant has made the above statement in describing the background of the invention, this statement is not relevant to the issue at hand. Appellant's statement does not constitute an admission that it was known to select a view perspective from the sensor object along the boresight. Appellant's statement does not constitute an admission that it was known to select objects of a satellite system analysis scenario that are capable of causing obscuration. Appellant's statement does not constitute an admission that it was known to provide a graphical display to a user, during an animation, portraying the amount of obscuration of a sensor pattern, and source of obscuration of the sensor pattern, over a predetermined time period.

The Blank disclosure is directed to an entertainment device and enables modification of an image by substituting a selected background image in place of an original background image. The selection taught has nothing to do with sensor obscuration, nor does it have anything to do with selecting a particular view perspective.

The Cok disclosure is directed to an image processing algorithm that modifies an image by intentionally obscuring a selected portion of the image by blending that portion with surrounding parts of the image. This pixel-by-pixel blending process is essentially the exact opposite of the claimed

invention. Rather than making the selected portion stand out with a contrasting color, the Cok algorithm makes the selected portion blend into its surroundings and become indistinct. The selection taught by Cok has nothing to do with sensor obscuration, nor does it have anything to do with selecting a particular view perspective.

Thus, when the Claffey *et al.*, Blank, and Cok references and the admission are considered together, they do not provide a suggestion or teaching concerning selecting objects corresponding to sensor obscuration or selecting a particular view perspective.

For the above reasons, Appellant respectfully submits that the Examiner has not established a *prima facie* case of obviousness with respect to claims 1-18, 23-26, and 30-35.

B. The Prior Art Teaches Away From The Claimed Invention

The claimed invention would have been further nonobvious because the prior art teaches away from the claimed invention.

It is not appropriate to combine references when the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 U.S.P.Q. 769, 779 (Fed. Cir. 1983).

The Cok reference teaches that it is desirable to modify an image by intentionally obscuring a selected portion of the image by blending that portion with surrounding parts of the image.

This pixel-by-pixel blending process is essentially the exact opposite of the claimed invention, which calls for graphically displaying to a user, during an animation, a portrayal of the amount of obscuration of a sensor pattern, and the source of obscuration of the sensor pattern. *See* independent claims 1, 7, 13, 23, and 25. Rather than making the selected portion stand out with a contrasting color so as to make the obscuration amount readily apparent, the Cok algorithm makes the selected portion blend into its surroundings and become indistinct.

Accordingly, Appellant respectfully submits that the Examiner has further failed to establish a *prima facie* case of obviousness with respect to claims 1-18 and 23-26.

C. Claims Are Limited To Satellite Sensor Obscuration

The Examiner contends that the recited satellite sensor obscuration is merely a statement of intended use of image analysis and, thus, not a meaningful limitation of the claims. Appellant respectfully submits that satellite sensor obscuration is a limitation to be accorded patentable weight.

In the case of the apparatus claims 25 and 26, the recitations of "objects of a satellite system analysis scenario that are capable of causing obscuration," "portraying the amount of obscuration," "calculating the percentage of obscuration" are

not merely statements of intended use because the actions recited are software steps implemented via a machine, the implementation of these actions thus constitute structural limitations.

The Examiner has cited case law in support of his position that the sensor obscuration limitations indicate only intended use. *In re Casey*, 152 U.S.P.Q. 135 (C.C.P.A. 1967); *In re Otto*, 136 U.S.P.Q. 148 (C.C.P.A. 1963). However, the authority cited by the Examiner does not address the special situation of apparatus structure being a computer implementing software. The *Casey* opinion analyzed the patentability of an apparatus claim for a tape dispenser, not a computer implementing software. The *Otto* opinion analyzed the patentability of an apparatus claim for a hair curler, not a computer implementing software.

Furthermore, it is the published PTO position that the line of cases to which *Casey* and *Otto* pertain is limited to claims directed to machinery which works upon an article or material in its intended use. M.P.E.P. § 2115 (8th ed., Rev. 1 2003). The claimed apparatus is not intended for use to work upon an article or material.

In the case of the process (or method) claims 1-12 and 30-32, Appellant respectfully submits that any recited actions in the body of the claim (including those actions recited as

involving a "satellite," a "sensor," and "obscuration") are material limitations of the claims and may not be read out of the claim as mere intended use. The "statement of intended use" canon of claim construction is not germane to the functional acts recited in the body of a process (or method) claim.

In the case of the computer program product claims 13-18 and 33-35, Appellant respectfully submits that the recited software instructions embodied on the computer readable medium are material limitations of the claims. It is further respectfully submitted, that by analogy to process (or method) claims, the "statement of intended use" canon of claim construction is not germane to the instructions embodied on the computer readable medium of a computer program product claim.

In the case of the signal bearing medium claims 23 and 24, Appellant respectfully submits that any recited aspects of the signal segments in the body of the claim (including those aspects recited as involving a "satellite," a "sensor," and "obscuration") are material limitations of the claims and may not be read out of the claim as mere intended use.

For the above reasons, Appellant respectfully submits that the claim language concerning satellite sensor obscuration do limit the claims and cannot properly be read out of the claims.

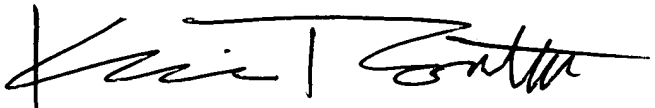
IX. CONCLUSION

For the above reasons, Appellant respectfully requests that the enablement rejection (Issue 1), the anticipation rejections (Issues 2, 3, and 4), and the obviousness rejection (Issue 5) be reversed.

The present Brief on Appeal is being filed in triplicate.

Appellant hereby petitions for any extension of time that may be required to maintain the pendency of this case, and any required fee for such extension is to be charged to Deposit Account No. 18-1579.

Respectfully submitted,
ROBERTS ABOKHAIR & MARDULA, LLC



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APPENDIX

Claims 1-18, 23-26, and 30-35 as finally rejected:

1. *(Previously Presented)* A process for sensor obscuration analysis, implemented via a programmable machine, the process comprising:

animating a three-dimensional visualization of a satellite that includes a sensor object, the sensor object having a boresight and a sensor pattern;

selecting a view perspective from the sensor object along the boresight;

selecting objects of a satellite system analysis scenario that are capable of causing obscuration;

assigning a first color to the selected objects;

assigning to the sensor pattern a color that contrasts with the first color, such that, when the sensor pattern is superimposed over a visual display of the satellite system analysis scenario, portions of the sensor pattern that overlap with unselected objects and background appear in a different color than do portions of the sensor pattern that overlap with selected objects;

counting and recording the quantities of pixels of each color in the sensor pattern, the counting and recording being

carried out at each time step of animation of the satellite system analysis scenario;

providing a graphical display to a user, during the animation, portraying the amount of obscuration of the sensor pattern, and source of obscuration of the sensor pattern, over a predetermined time period; and

calculating the percentage of obscuration over said predetermined time period on the basis of the recorded pixel quantities, the calculated percentage of obscuration being displayed to a user.

2. *(Original)* The process for sensor obscuration analysis of claim 1, the process further comprising:

translating a projection of the sensor pattern so that the sensor pattern is projected from edges of the sensor object.

3. *(Original)* The process for sensor obscuration analysis of claim 1, wherein the graphical display and the displayed calculated percentage of obscuration is used for planning missions to avoid sensing activities during periods of excessive obscuration.

4. *(Original)* The process of sensor obscuration analysis of claim 1, wherein the graphical display and the displayed

calculated percentage of obscuration is used for planning missions to schedule maneuvers to eliminate or reduce obscuration.

5. *(Original)* The process of sensor obscuration analysis of claim 1, wherein the graphical display and the displayed calculated percentage of obscuration is used for the purpose of determining whether re-positioning of objects attached to the satellite can eliminate or reduce obscuration.

6. *(Original)* The process of sensor obscuration analysis of claim 1, wherein the counting and recording of pixels is carried out such that pixels near the edge of the sensor pattern are given a reduced weight to compensate for the fact that a display screen of the programmable machine is flat, while the sensor pattern is spherical.

7. *(Previously Presented)* A method of analyzing sensor obscuration using a satellite system analysis program having animated three-dimensional visualization of a satellite that includes a sensor object, the sensor object having a boresight and a sensor pattern, the method comprising:

selecting a view perspective from the sensor object along the boresight;

selecting objects of a satellite system analysis scenario that are capable of causing obscuration;

assigning a first color to the selected objects;

assigning to the sensor pattern a color that contrasts with the first color, such that, when the sensor pattern is superimposed over a visual display of the satellite system analysis scenario, portions of the sensor pattern that overlap with unselected objects and background appear in a different color than do portions of the sensor pattern that overlap with selected objects;

counting and recording the quantities of pixels of each color in the sensor pattern, the counting and recording being carried out at each time step of animation of the satellite system analysis scenario;

providing a graphical display to a user, during the animation, portraying the amount of obscuration of the sensor pattern, and source of obscuration of the sensor pattern, over a predetermined time period; and

calculating the percentage of obscuration over said predetermined time period on the basis of the recorded pixel quantities, the calculated percentage of obscuration being displayed to the user.

8. *(Original)* The method of analyzing sensor obscuration of claim 7, the method further comprising:

translating a projection of the sensor pattern so that the sensor pattern is projected from edges of the sensor object.

9. *(Original)* The method of analyzing sensor obscuration of claim 7, wherein the graphical display and the displayed calculated percentage of obscuration is used for planning missions to avoid sensing activities during periods of excessive obscuration.

10. *(Original)* The method of analyzing sensor obscuration of claim 7, wherein the graphical display and the displayed calculated percentage of obscuration is used for planning missions to schedule maneuvers to eliminate or reduce obscuration.

11. *(Original)* The method of analyzing sensor obscuration of claim 7, wherein the graphical display and the displayed calculated percentage of obscuration is used for the purpose of determining whether re-positioning of objects attached to the satellite can eliminate or reduce obscuration.

12. *(Original)* The method of analyzing sensor obscuration of claim 7, wherein the counting and recording of pixels is

carried out such that pixels near the edge of the sensor pattern are given a reduced weight to compensate for the fact that a display screen is flat, while the sensor pattern is spherical.

13. *(Previously Presented)* A computer program product for enabling a computer to perform analysis of sensor obscuration, the computer program product comprising:
software instructions for enabling the computer to perform predetermined operations, and
a computer readable medium embodying the software instructions;
the predetermined operations comprising:

animating a three-dimensional visualization of a satellite that includes a sensor object, the sensor object having a boresight and a sensor pattern;

selecting a view perspective from the sensor object along the boresight;

selecting objects of a satellite system analysis scenario that are capable of causing obscuration;

assigning a first color to the selected objects;

assigning to the sensor pattern a color that contrasts with the first color, such that, when the sensor pattern is superimposed over a visual display of the satellite system analysis scenario, portions of the sensor pattern that

overlap with unselected objects and background appear in a different color than do portions of the sensor pattern that overlap with selected objects;

counting and recording the quantities of pixels of each color in the sensor pattern, the counting and recording being carried out at each time step of animation of the satellite system analysis scenario;

providing a graphical display to a user, during the animation, portraying the amount of obscuration of the sensor pattern, and source of obscuration of the sensor pattern, over a predetermined time period; and

calculating the percentage of obscuration over said predetermined time period on the basis of the recorded pixel quantities, the calculated percentage of obscuration being displayed to the user.

14. *(Original)* The computer program product of claim 13, the predetermined operations further comprising:

translating a projection of the sensor pattern so that the sensor pattern is projected from edges of the sensor object.

15. *(Original)* The computer program product of claim 13, wherein the graphical display and the displayed calculated

percentage of obscuration is used for planning missions to avoid sensing activities during periods of excessive obscuration.

16. *(Original)* The computer program product of claim 13, wherein the graphical display and the displayed calculated percentage of obscuration is used for planning missions to schedule maneuvers to eliminate or reduce obscuration.

17. *(Original)* The computer program product of claim 13, wherein the graphical display and the displayed calculated percentage of obscuration is used for the purpose of determining whether re-positioning of objects attached to the satellite can eliminate or reduce obscuration.

18. *(Original)* The computer program product of claim 13, wherein the counting and recording of pixels is carried out such that pixels near the edge of the sensor pattern are given a reduced weight to compensate for the fact that a display screen of the programmable machine is flat, while the sensor pattern is spherical.

19-22. *(Canceled)*

23. *(Previously Presented)* A signal bearing medium propagating a signal for use in sensor obscuration analysis, the

signal propagated via the signal bearing medium comprising:

an animation signal segment providing for animated three-dimensional visualization of a spacecraft having a sensor object, the sensor object having a boresight and a sensor pattern;

a perspective selection signal segment providing for a visualization view from the perspective of said sensor object, along said sensor object's boresight;

a selection signal segment that enables selection of obscuring objects to be taken into account in the obscuration analysis;

a simplification signal segment that simplifies visual display provided by said animation signal segment to show the selected obscuring objects in a first color;

a distinguishing signal segment that assigns a second color to portions of the sensor object's field of view that are obscured by the selected obscuring objects and a third color to those portions of the sensor object's field of view that are not obscured, to thereby distinguish obscured portions of the sensor object's field of view from unobscured portions of the sensor object's field of view;

a quantifying signal segment that counts and records a quantity of pixels corresponding to obscured portions of the sensor object's field of view at each of plural animation time

steps, and that counts and records a quantity of pixels corresponding to unobscured portions of the sensor object's field of view at each of the plural animation time steps; and

a results signal segment that calculates, based on the quantities of pixels counted and recorded by said quantifying signal segment, and reports to a user percent obscuration of the sensor object's field of view over a predetermined time period.

24. *(Previously Presented)* The signal bearing medium of claim 23, the signal propagated via the signal bearing medium further comprising:

a projection signal segment that projects said sensor pattern from edges of said sensor object.

25. *(Previously Presented)* A computer system adapted to analyze sensor obscuration, comprising:

a processor, and

a memory including software instructions adapted to enable the computer system to perform operations comprising:

animating a three-dimensional visualization of a satellite that includes a sensor object, the sensor object having a boresight and a sensor pattern;

selecting a view perspective from the sensor object along the boresight;

selecting objects of a satellite system analysis scenario that are capable of causing obscuration;

assigning a first color to the selected objects;

assigning to the sensor pattern a color that contrasts with the first color, such that, when the sensor pattern is superimposed over a visual display of the satellite system analysis scenario, portions of the sensor pattern that overlap with unselected objects and background appear in a different color than do portions of the sensor pattern that overlap with selected objects;

counting and recording the quantities of pixels of each color in the sensor pattern, the counting and recording being carried out at each time step of animation of the satellite system analysis scenario;

providing a graphical display to a user, during the animation, portraying the amount of obscuration of the sensor pattern, and source of obscuration of the sensor pattern, over a predetermined time period; and

calculating the percentage of obscuration over said predetermined time period on the basis of the recorded pixel quantities, the calculated percentage of obscuration being displayed to the user.

26. *(Original)* The computer system adapted to analyze sensor obscuration of claim 25, said software instructions included in the memory being further adapted to enable the computer system to perform operations comprising:

translating a projection of the sensor pattern so that the sensor pattern is projected from edges of the sensor object.

27-29. *(Canceled)*

30. *(Previously Presented)* A method of upgrading a satellite system analysis program that performs animated three-dimensional visualization of a satellite, the satellite having a sensor object, the sensor object having a sensor pattern and a boresight, the method comprising:

supplementing the available view perspectives for the satellite system analysis program so as to include a view from the sensor, along the boresight of the sensor;

supplementing the satellite system analysis program with a code segment that enables a user to select objects to be taken into account for analysis of obscuration of the sensor pattern as viewed along the boresight of the sensor;

supplementing the satellite system analysis program with a code segment that simplifies visual display, as viewed along the boresight of the sensor, to show selected objects in a first

color;

supplementing the satellite system analysis program with a code segment that assigns colors to a representation of the sensor pattern of the sensor object, so as to distinguish those portions of the sensor object's field of view that are obscured by selected objects from those portions of the sensor object's field of view that are not obscured by selected objects;

supplementing the satellite system analysis program with a code segment that counts and records the quantity of pixels corresponding to obscured and unobscured portions of the sensor object's field of view at each of plural animation time steps; and

supplementing the satellite system analysis program with a code segment that calculates, based on recorded quantities of pixels corresponding to obscured and unobscured portions of the sensor object's field of view at each of plural animation time steps, an obscuration percentage over a predetermined time period, the results of the calculations being reported to a user.

31. *(Original)* The method of upgrading a satellite system analysis program of claim 30, wherein the objects to be taken into account for obscuration analysis are selected from the group consisting of: the satellite, protrusions from the spacecraft,

the central body about which the satellite orbits, and celestial bodies.

32. *(Original)* The method of upgrading a satellite system analysis program of claim 30, the method further comprising:

supplementing the satellite system analysis program with a translation option for the sensor object that projects the sensor pattern from the edges of the sensor object.

33. *(Previously Presented)* A computer program product for enabling a computer to upgrade a satellite system analysis program that performs animated three-dimensional visualization of a satellite, the satellite having a sensor object, the sensor object having a sensor pattern and a boresight, the computer program product comprising:

software instructions for enabling the computer to perform predetermined operations, and

a computer readable medium embodying the software instructions;

the predetermined operations comprising:

supplementing the available view perspectives for the satellite system analysis program so as to include a view from the sensor, along the boresight of the sensor;

supplementing the satellite system analysis program with a code segment that enables a user to select objects to be

taken into account for analysis of obscuration of the sensor pattern as viewed along the boresight of the sensor;

supplementing the satellite system analysis program with a code segment that simplifies visual display, as viewed along the boresight of the sensor, to show selected objects in a first color;

supplementing the satellite system analysis program with a code segment that assigns colors to a representation of the sensor pattern of the sensor object, so as to distinguish those portions of the sensor object's field of view that are obscured by selected objects from those portions of the sensor object's field of view that are not obscured by selected objects;

supplementing the satellite system analysis program with a code segment that counts and records the quantity of pixels corresponding to obscured and unobscured portions of the sensor object's field of view at each of plural animation time steps; and

supplementing the satellite system analysis program with a code segment that calculates, based on recorded quantities of pixels corresponding to obscured and unobscured portions of the sensor object's field of view at each of plural animation time steps, an obscuration percentage over a

predetermined time period, the results of the calculations being reported to a user.

34. *(Original)* The computer program product for enabling a computer to upgrade a satellite system analysis program recited in claim 33, wherein the objects to be taken into account for obscuration analysis are selected from the group consisting of: the satellite, protrusions from the spacecraft, the central body about which the satellite orbits, and celestial bodies.

35. *(Original)* The computer program product for enabling a computer to upgrade a satellite system analysis program recited in claim 33, the predetermined operations further comprising:

supplementing the satellite system analysis program with a translation option for the sensor object that projects the sensor pattern from the edges of the sensor object.